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SOCIAL DESIRABILITY: CONSUMER ASPECTS^{*}

1. INTRODUCTION TO CONSUMER BEHAVIOUR

Joop de Boer

Chapter 4 is the first of two chapters on the question whether a diet shift is socially desirable. It takes a behavioural perspective, whereas Chapter 5 is oriented towards processes at the level of organisations and markets. Accordingly, the main theme of the present chapter is how a diet shift is related to the behaviour of producers and consumers. The degree to which a shift “fits” into existing behavioural patterns is an important argument for its desirability. The same applies even more strongly to its future fit into the behavioural patterns of the next decades. Alternatively, whether a lack of fit will create an insurmountable problem depends on the feasibility of the measures that can be taken to mitigate the main shortcomings of the options.

What conditions make it attractive for producers and consumers to select NPFs instead of meat protein foods? From the perspective of producers, the answer may seem simple. The reasons for a producer to launch a new food product may be quite diverse, but they can always be translated into traditional business criteria, aimed at short-term and long-term profits. Given the consumer-oriented food market of today (Warde, 1997), it can simply be argued that the decisions of consumers will determine whether the introduction of a new food product will become a success or a failure. However, this statement is far too strong. Notably, producers are able to shape the food choices of consumers step by step in a certain direction (e.g. the direction of processed foods). Also, it is up to producers to develop new products and to decide whether they are ripe for the market. In sum, their role should not be neglected.

This chapter will focus on the factors that influence food choices of consumers. The analysis includes both short-term and long-term influences and it will pay due attention to the many linkages between the activities of

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food producers and consumers. These linkages are typical of the way in which food supply has been organised in modern society. They demonstrate that producers and consumers are almost continuously engaged in the exchange of signals about food-related opportunities and preferences (e.g. special offers, quality products). This does not mean, however, that the signals that they receive from each other are always clear. Consumers who buy meat products, for example, might have very mixed feelings about meat, but this attitude does not reveal what kind of alternative they would prefer. In other words, consumers' preferences are far from fixed and cannot entirely be read off their current purchases.

To get more insight into the various influences on food choices, this chapter argues that human behaviour is a very flexible phenomenon and that each particular manifestation of it can be the result of many determinants (De Boer, 2004). These determinants can be sorted into a logical order on the basis of the time frames that they involve. The fact that, for example, impulse buying has another time frame than consciously buying says something about the different underlying processes. Generally, the time frames that are relevant for behaviour range from short-term (i.e. taking less than a second) to long-term (i.e. taking almost a lifetime) and extremely long-term (i.e. taking many human generations).

The most obvious influences on behaviour are the perceptual and rational processes that enable a person to make sense of day-to-day events, such as an invitation to try some of the food. Because sense making is in essence a backward looking activity (Weick, 1995), the short-term influences on behaviour may refer to the taste of the food and the person's ideas about its origin. The behaviour of a person who is in doubt about the quality of a food product served by a host may be partly influenced by the bonds of convention and the fear of what this host will think (i.e. social processes). Also relevant may be the person's experiences with the business practices that are common in a certain food supply chain (e.g. fast food restaurants). In short, the behaviour in question is not only a function of processes within the person, but also of social and organizational processes that act as "proximal" causes of behaviour. These processes will often take days to decades and may change in a certain direction during the person's lifetime.

Moving from processes that are internal and proximal to more distal processes (i.e. long-term causes), we can see determinants of behaviour that will not dramatically change during the lifetime of an individual. These relatively stable processes can influence the person tasting the food, if, for example, he or she is drawn to beliefs about purity and danger that result from broadly shared worldviews (e.g. philosophies of life, beliefs about magical powers). These worldviews have gradually changed over the past millennium, due to a process of cultural modernization. Unlike mediaeval

men and women, modern people will not expect solutions from magical powers, but they may still be sensitive to some of these beliefs under conditions of uncertainty.

A final category involves evolutionary processes, which have shaped human capabilities to cope with the environment, for example the ability to make a quick distinction between sweet (i.e. rich in calories) and bitter tasting (i.e. possibly poisonous) foods. The brain systems responsible for evaluating stimuli display a so-called “negativity bias”, which means that negative stimuli (e.g. a suspect bitter taste) have a greater impact on information processing than do positive stimuli.

Figure 4.1 shows how the processes mentioned above can be arranged in a cascade-like framework. An important practical message of the framework is that the distal factors provide the context in which the more proximal or internal factors can have their effect. For example, the taste of a food may only be pleasurable for those persons who have already learned to appreciate the corresponding cuisine. Similarly, a “free-range” label will only have a moral effect on people who value animal welfare. The asymmetrical impact of positive and negative influences is evident from the following:

- The pleasure of eating might easily be spoiled by unpleasant ideas about the origin of the food.
- However, the unpleasant taste of a food will not easily be improved by pleasant ideas about its origin.

The framework of Figure 4.1 can help to generate information on the chances that a diet shift will be promoted or inhibited. Specifically, it is important to know whether all the influences on a particular behaviour point in the same direction and support the relevant changes. In the case that a particular behaviour is difficult to change, such as overeating, it is essential to combine as many influences as possible (e.g. organizational, social, rational and perceptual). It should be kept in mind, however, that each type of influence has its own time frame. For example, it will take more time to improve the social status of novel products than to increase the practical knowledge of consumers.

Accordingly, the framework opens the way to look at influences on behaviour from various perspectives. This will be done in the next sections, which describe three consumer-oriented research projects. Section 4.2 takes a long-term view on behaviour; it starts at the level of distal processes and analyses the socio-cultural changes in society that can make a diet shift more attractive or less attractive to producers and consumers.

In contrast, Sections 4.3 and 4.4 take a short-term view on behaviour; these projects start at the level of perceptual and rational processes to analyse consumers’ reactions to novel products. More specifically, Section 4.3 addresses the way in which NPFs may replace meat in current dietary

patterns. In addition, Section 4.4 tries to get more insight into the appreciation of NPFs, their appropriateness for various meals, and the way sensory preferences can be translated into product characteristics and physical parameters.

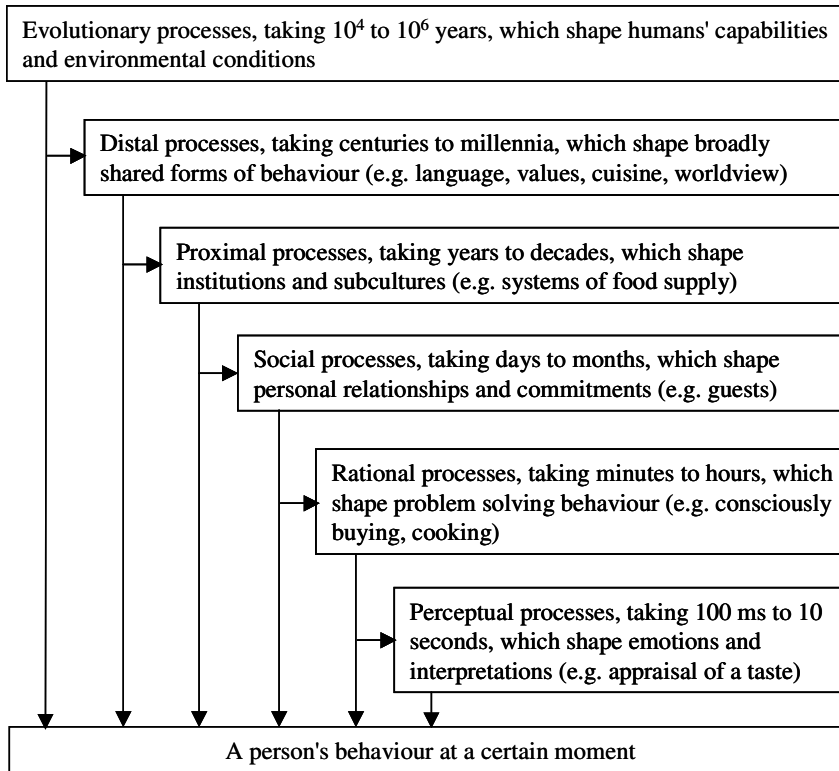


Figure 4-1. A cascade-like framework of influences on behaviour.

2. SOCIO-CULTURAL POTENTIAL

Joop de Boer

2.1 Introduction

What is the potential for a diet shift in relation to long-term socio-cultural changes? In answering this question, this section focuses on food-related themes and lifestyles, which can provide incentives (but also disincentives) for consumers and producers to become less dependent on meat proteins. Some relevant examples are the increasing significance that Western consumers attribute to animal welfare and the growing appreciation of vegetarian meals, not only by consumers, but also by nutritionists. Given the various manifestations of these changes, the question should be raised whether they will continue to grow and make a substantial impact on the consumption of meat. An obvious alternative is that they will fade away like other food fads and fashions.

From a methodological point of view, studying the links between food choice criteria and long-term socio-cultural development is a challenging project. The main strategy chosen here is the development of a framework that sorts influences on behaviour into a logical order (Figure 4.1). Generally, a long-term development will create opportunities for food choices that match its general direction, whereas it will put constraints on others. Accordingly, it may be expected that those food choice criteria that appear to be part of a long-term change will have more impact in the future than criteria that are only based on short-term trends.

The combination of long-term and short-term approaches is not a simple task, as there are no databases and tools to support this type of research. Nevertheless, it is possible to use insights from the relevant disciplines (i.e. psychology, sociology, anthropology, history) as elementary building blocks, and to test at least some implications by small-scale “experiments” such as research on different versions of a questionnaire with built-in suggestions that unobtrusively remind consumers of meat’s animal origin (Hoogland *et al.*, 2005; see below). In the next section, the role of Western modernization processes is analysed as an example of long-term influences on food choice

criteria. These results will be combined with a brief description of the changes that have influenced food supply in the last few decades.

2.2 Results

Many of the links between current food choices and long-term socio-cultural development can be explained in relation to Western modernization processes. To put it simply, modern society can be distinguished from its predecessor by the potential democratisation of both its wealth (including meat eating) and its political process (Levine, 2001: 11). In terms of important periods in world history, the “modern” period is said to have started in 1900 and its predecessor in 1350, when Europe had to cope with the social, economic and political effects of the Black Death (Goldstone, 2005). In this “pre-modern” period, people could easily burst out into emotional behaviour, including violence against other people and animals. Their way of life was strongly dependent on their social and moral rank in society. It is against this background that a number of socio-cultural changes should be mentioned that are part and parcel to the overall process of modernization (see Table 4.1). They comprise:

- the increasing self-control considered typical of Western civilized man, such as the self-control of animal-like behaviour (since about 1500, see Elias, 1978),
- the rise of consumerism (or the belief that it is good to buy and use a lot of goods) among the middle classes (since about 1700, see Stearns, 2001), and
- the growing importance of an “engineering culture” characterized by the systematic application of scientific knowledge to societal issues (since about 1800, see Carroll-Burke, 2001).

To a certain extent the changes were supported by the mainstream of society, but they were also criticized by one or more counter-movements. The nineteenth century, for example, saw on the one hand a “democratization of meat” among European working-class families, influenced by the agricultural and industrial revolutions (Knapp, 1997). On the other hand, there were growing moral objections to the subjugation of animals, resulting in the foundation of the first vegetarian societies (Thomas, 1983).

Table 4-1. Main characteristics of three socio-cultural processes that mediate Western modernization.

Long-term changes	Direction of mainstream	Direction of counter-movement
Increasing self-control to weaken the link between impulses and behaviour (since about 1500).	Development of more predictable and civilized behaviour, suppressing every activity felt to be “animal”, such as spitting or gobbling or the tendency to sniff at food.	Discovery by the upper and middle classes of “pacified nature” as an escape from civilizing rules, a source of pleasure and knowledge (reason for protests against the cruel treatment of animals).
Break with the rule that people should consume according to their rank in society (since about 1700).	Development of social arrangements (e.g. shops) and personal lifestyles (e.g. those of shoppers) in pursuit of the belief that it is good to buy and use a lot of goods.	From its early beginning in Britain, France, the Low Countries and parts of Germany and Italy, consumerism has provoked opposition, inspired by various moral, esthetical and political themes.
Break with the link between what is morally right and scientifically true (since about 1800).	Development of “engineering cultures”, which use the powers of “engine science” in the laboratory for other cultural forms such as agriculture and medicine.	Rise of various subcultures concerned, among other things, with natural foods and holistic medicines, trusting the self-healing capacity of the human body.

The process of modernization brought many changes in dietary choice and culinary technique. Based on reports on the history of food, Table 4.2 summarizes a number of relevant differences between on the one hand the sixteenth/seventeenth century and on the other hand the beginning of the twenty-first century. Due to the prevailing prominent position of the court society in France, most of the changes were at first part of a French-style modernization before they became accepted more generally. As far as meat is concerned, many changes were particularly related to its animal origin. An interesting example is the practice of bringing the whole dead animal, or large parts of it, to the table, where the meat was to be carved by the master of the house or by distinguished guests. Research by the historian Flandrin (1999) shows that there were dozens of animal species served on the tables of the French aristocrats, although this number decreased between 1500 and 1650. There was, for example, a decreasing consumption of various large birds (e.g. swan). By way of contrast, the status of beef rose and much attention was paid to the particular cut of meat.

The list of observations in Table 4.2 suggests a number of significant diet shifts. Each of the differences must have had one or more proximal causes

that explain how changes were created. For example, that members of the elite ate so many types of animal indicates that 17th century diet was still largely determined by fluctuations in availability as a consequence of the prevailing meteorological conditions (Flandrin, 1999). Interestingly, beef was considered “crude” and dismissed as indigestible by chefs in the aristocratic kitchens. Members of the elite left “gross” meats as well as most vegetables to the common people, whose stomachs were supposedly more robust. The elite ate only “delicate” fowl, relatively “light” fish and soft wheat bread.

Table 4-2. Table 4.2. Some meat-related practices that have changed between the 16th-17th century (see Flandrin, 1999) and the beginning of the 21st century.

16th-17th century	Beginning of the 21st century
There were very large differences between high and low members of society.	A large part of the population of Western countries can afford to eat meat.
Rich people ate many types of animals, including various birds such as swans.	Consumers mainly choose a few types of animal.
Their cooks served large parts of the animal, which were carved at the table.	Consumers seldom serve whole animals; instead they serve cuts of meat.
It was a matter of good manners that upper class men should be able to cut meat from a pheasant still decorated with its feathers.	The cuts are bought at stores in which the carcasses have been hidden from the customer's eye.
Scientists agreed that the rich needed to eat birds to keep their intelligence and sensibility more alert.	The nutritional literature begins to appreciate the value of low-meat diets and vegetarian diets.
The working classes were considered best off eating large amounts of vegetables.	Nutritionists see vegetables as an essential part of each diet.
Local authorities tried to ensure an adequate supply of “good and honest” food.	Ensuring the provision of “good and honest” food is a task for supra-national authorities.

In the course of the 17th century, progress in the arts of butchery and cooking made it possible that the status of beef rose and that more attention was paid to the particular cut of meat. Accordingly, the serving of large parts of the animal to be carved at the table slowly went out of use. This decreasing practice is also connected with the gradual reduction in the size of the household and the transference of household activities to specialists (Elias, 1978).

Although the direct causes and the precise timing of these changes may not always be clear, their consequences are part of the long-term process of Western modernization. For example, people got fewer reminders that the meat dish has something to do with the killing of an animal. The practice of slaughtering has more and more been moved behind the scenes of social life (Vialles, 1994). According to Elias (1978: 120), this shift means that the mediaeval standard of feeling by which the sight and carving of a dead animal on the table were actually pleasurable, or at least not at all

unpleasant, has been replaced by another standard by which reminders that the meat dish has something to do with the killing of an animal are avoided. Although this development is not uniform, the general direction of the changes seems to be the same. In many of our meat dishes the animal form is so concealed and changed by the art of its preparation and carving that during a meal one is scarcely reminded of its origin.

The long-term processes mentioned above can be complemented by processes that have taken place during the last few decades (see Table 4.3). These processes include shifts in the way people manage to organize their household, taking due account of differences in economy of scale. For example, if the costs of preparing a meal are compared per unit time of the eaters, a decreasing number of persons per household will make convenience food more attractive (Beardsworth and Keil, 1997; Warde, 1997). Other important processes refer to the way producers manage to supply foods and the way the authorities manage to control the public dimensions of food.

Table 4-3. Main characteristics of three proximal changes that have influenced food supply in the past decades.

Proximal changes	Main moderators	Direction of consequences
Shifts in the way people manage to organize their household.	Decreasing household size, less time spent on household activities, more income per person.	More demand for convenient products and ready-made meals, more tolerance of diverging food preferences within a household.
Shifts in the way producers manage to supply foods.	Growing influence of world markets, more emphasis on processing and packaging, less emphasis on primary production, supply chains more dominated by branded manufacturers and large retailers.	Growing number of products, more differentiation of qualities (taste, nutrition, health, convenience, moral concerns), more diverse points of sale (supermarkets, food courts, takeaways).
Shifts in the way the authorities manage to control the public dimensions of food.	Growing influence of supranational institutions, more emphasis on standardization, greater role for science-based notions of nutrition, health and animal welfare.	More communication about risk factors focusing on single nutrients (e.g. fatty acid profile) or functional ingredients.

One of the almost unnoticed consequences common to the shifts mentioned in Table 4.3 is their match with the long-term process of paying less attention to the meat-producing animal as a whole. Modern consumers seldom serve whole animals, but they serve cuts of meat that they have bought in stores in which the carcasses have been hidden from the customer's eye. Moreover, partly as a result of concerns about risk factors, such as saturated fatty acids, there has been a shift in consumption toward

poultry and fish and away from beef and pork. As opposed to whole roasts, many consumers use products processed further, such as fillets.

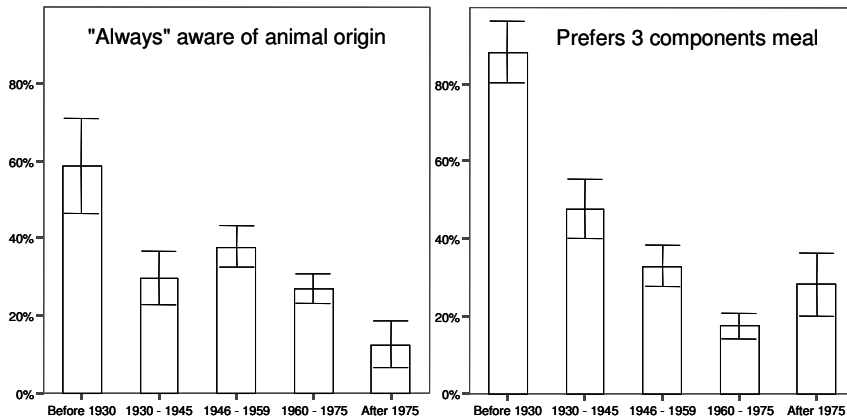


Figure 4-2. Share of consumers “always” giving thought to the animal origin of meat (left) and preferring a three components meal (right) in relation to year of birth. (Note: the bars are shown with standard errors; the sample of 313 supermarket customers is described in Hoogland *et al.*, 2005.)

The psychological and socio-cultural implications of this development have not yet been fully explored. However, some results of research on consumers give an interesting clue. In May 2003, a sample of customers of a discounter plus one of a more expensive supermarket in the city of Rotterdam were asked to fill out a questionnaire, which contained items measuring food choice criteria and attitudes towards the association between meat and animals, such as the degree to which they give thought to meat’s animal origin (see further details in Hoogland *et al.*, 2005). Only those customers were included who said that they ever bought meat. The results suggest that many consumers – at least those who live in a city – are not constantly aware of the animal origin of meat and that this awareness strongly decreases among the younger generations (left-hand part of Figure 4.2). Under the assumption that these differences between consumer generations reflect cultural changes on a time scale of decades, this result is in agreement with the long-term trend. Another interesting result is that the “three components” meal (meat, potatoes, vegetables) that was dominant in the Netherlands during the second part of the 20th century has lost significant popularity among the younger generations (right-hand part of Figure 4.2). This may indicate that meat is less used as the central part of the meal. Although it should be emphasized that these consumers had certainly not become vegetarians, their attitude towards meat’s origin showed a

remarkable sensitivity. After an unobtrusive suggestion that reminded them of meat's animal origin, they gave more weight to animal welfare as a food choice criterion than without that reminder.

2.3 Conclusions

Any attempt to summarize long-term processes in a few paragraphs should arouse suspicion, as it incurs the risk of taking the phenomena being described out of their historical context. Combining long-term and short-term influences on behaviour may easily give the impression of juxtaposing different types of work as if there is no difference between them and they can just be “added together”. There is, however, no alternative to find out more about the potential for a diet shift in relation to long-term socio-cultural changes. Moreover, even if the direct causes and the precise timing of the various changes are not always clear, the general direction of their consequences is quite understandable.

The overall picture is that current manifestations of a certain ambivalence towards meat fit in a long-term process in which reminders of meat's animal origin have disappeared. This is a development that will continue to deepen in the future. The fact that many people are less aware of the animal origin of meat may be interpreted in terms of indifference toward the origins of proteins. This opens possibilities for NPFs, particularly in view of the decreasing popularity of the “three components meal” with its prominent cut of meat. If meat is less used as the central part of a meal, it will become feasible to design ready-made meals that contain more plant proteins and less meat or no meat at all (meat-free meals). If these meals are being developed and prepared by food producers, and consumers can choose such a meal without thinking about the source of the proteins, this strategy may even create a substantial shift from meat to plant protein foods without much consumer involvement.

However, although such a low-involvement approach will fit in a long-term socio-cultural development, it may not be the optimal strategy to pursue more sustainable food choices. One of its drawbacks is that it will reinforce mindless acceptance of technological changes. This mindless attitude is not in agreement with the preferences of consumers who have some affinity with one or more critical movements in society. These consumers want to be mindful of any potential value conflicts that technological innovations may bring about, including those associated with novel protein foods. Although they are only a small minority, their influence in society should not be underestimated. Therefore, it is of vital importance to involve both mainstream and critical consumers in discussions on food production methods.

Another reason to adopt a more transparent approach is related to the fact that meat will remain on the menu. The point is that people who are no longer aware of meat's animal origin will also be less inclined to pay attention to animal welfare. This process may have serious repercussions for other attempts to stimulate sustainable agriculture, for example, by promoting high quality meat from well-treated animals or by encouraging a high-plant and low-meat "Mediterranean" type of diet. From a sustainability perspective, these alternatives can go together with attempts to develop meat substitutes. Generally, an increase in the transparency of the food chain is likely to enhance sustainable food choices by producers and consumers.

3. SUBSTITUTION OF MEAT BY NPFs: FACTORS IN CONSUMER CHOICE

Annet Hoek

3.1 Introduction

What can be done to replace meat in current dietary patterns? In the Netherlands, meat is still an important part of the meal. The market share of meat as a hot meal component is 76% (PVE, 2003), and a vast majority (>80%) consumes meat at dinner more than three days a week (Aurelia!, 2002). As noted in Chapter 3, meat-free plant-based products that are intended to replace meat, so-called "meat substitutes", were introduced in Europe during the last decades (Davies and Lightowler, 1998; McIlveen *et al.*, 1999). However, the market for meat substitutes is still very small: about 1% of the total market for meat and meat products in the Netherlands (Aurelia!, 2002). This implies that in order to be successful, NPFs should be distinctive from meat substitute products currently on the market. To achieve a considerable reduction in the consumption of meat, NPFs should also be competitive with meat products (i.e. be better or cheaper). To develop such NPFs more information is necessary on consumer factors that play a role in the replacement of meat by meat substitute products, covering the whole consumption chain from product identification to repeated consumption over time.

This section is meant as a guide to NPF product development using the knowledge and the tools of food choice research. In studying factors that influence the choice for certain foods, three main components are usually

distinguished: the Food, the Person, and the Environment (Shepherd, 1989). This section focuses on the Person, or the consumer, and the interaction with the Food, or product. Since pea-derived NPFs are not on the market yet, meat substitutes that are currently available were used as a case study. After a description of different consumer segments that are buying meat or meat substitutes, the role of product identification, the consumption experience, and repeated consumption will be discussed in relation to the overall acceptance of meat substitute products.

3.2 Results

Consumer segments

As part of the marketing process, specific target markets should be selected for NPFs. Therefore, the market has to be divided into groups of buyers with different needs, characteristics or behaviour, who might require separate products or marketing mixes. This is called market segmentation (Kotler *et al.*, 1999). Two studies illustrate the different consumer segments with respect to meat substitute products. Since NPFs will not be aimed at vegetarians primarily, non-vegetarian consumers of meat substitute products are considered particularly interesting.

For the first study (Hoek *et al.*, 2004), we used a representative sample of consumers (i.e. the Dutch National Food Consumption Survey 1997/1998). Non-vegetarian consumers of meat substitutes were compared to vegetarians and meat consumers with respect to socio-demographic and attitudinal variables. Both vegetarians (n=63) and non-vegetarian consumers of meat substitutes (n=39) were comparable for socio-demographic characteristics: higher educated, higher social class, living more in urbanised regions and smaller households than meat consumers (n=4313). Attitudes to food were assessed by the food-related lifestyle questionnaire (Grunert *et al.*, 1997), which is intended to assess attitudes with respect to ways of shopping, quality aspects, cooking methods, consumption situations and purchasing motives. We found that vegetarians (n=32) had more positive attitudes towards importance of product information, speciality shops, health, novelty, ecological products, social events, and social relationships than meat consumers (n=1638). The health consciousness scale (Schifferstein and Oude Ophuis, 1998) that was used to assess attitudes to health supported earlier findings that vegetarians are more preoccupied with health. However, food-related lifestyle and health attitudes of non-vegetarian meat substitute consumers (n=17) were much more in line with those of meat consumers.

In 2003, a survey was performed to collect new consumer data after the occurrence of several meat crises after 1998 (e.g. BSE and foot-and-mouth disease) and the resulting growth in the meat substitute market. It was aimed

to provide more insight into factors and barriers acting on several levels of substitution of meat by meat substitute products. In this second study we used the usage frequency of meat substitutes as a basis for segmentation. Data was collected in the UK (a mature meat substitute market) and the Netherlands (a developing market) by means of a questionnaire that assessed demographic characteristics, food neophobia (the tendency to avoid new foods) by the Food Neophobia Scale of Pliner and Hobden (1992), food choice motives by the enhanced Food Choice Questionnaire (Lindeman and Väänänen, 2000; Steptoe *et al.*, 1995), opinions on meat substitutes, and the desired similarity of meat substitutes to meat. The respondents (UK: n=235, 10% vegetarian; NL: n=318, 6% vegetarian) were classified into three categories: non-users (UK-45%, NL-69%), light/medium users (UK-35%, NL-16%) and heavy users (UK-20%, NL-15%). Among heavy users (meat substitute consumption at least once a week), the percentage of respondents that said they never eat meat was 17% in the UK and 29% in the Netherlands. We found no significant difference in overall food neophobia levels between the UK (mean food neophobia score 28.8) and the Netherlands (29.1). When user groups were compared within countries, it was found that non-users were more food neophobic than light/medium users (see Figure 4.3). However, again heavy users display a higher tendency to avoid unfamiliar foods compared to light/medium users, which might be explained by a particular lifestyle and values attached to food.

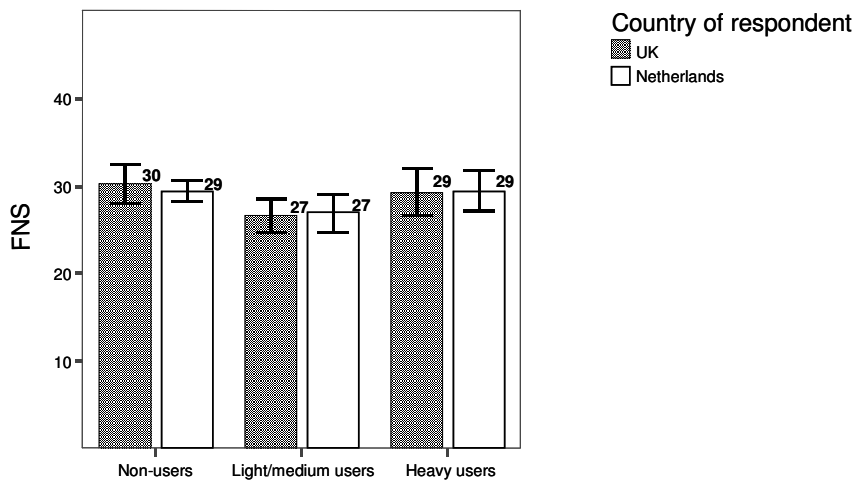


Figure 4-3. Food Neophobia Scores (FNS) of non-users, light/medium users (below once a week) and heavy users (once a week or over) of meat substitutes in the UK and the Netherlands. (The theoretical range of FNS is 10, very food neophilic, to 70, very food neophobic.)

With respect to overall differences in food choice motives between the two countries, Dutch respondents paid less attention to political values and more to price than respondents from the UK. Within countries it was found that a higher consumption of meat substitutes was related to higher importance attached to ethical food choice motives, such as ecological welfare (including animal welfare), political values, and natural content (preference for natural or organic food products). In contrast, non-users and light/medium users gave less weight to these motives. The non-users and light/medium users scored meat substitutes negatively for familiarity and luxury aspects and favourably for ethical aspects and weight control. As mentioned before, however, health and ethical aspects are not the main food choice motives of this group. In addition, respondents rated to which degree meat substitutes should resemble meat. Non-users and light/medium users indicated a preference for a meat substitute with a high similarity to meat for smell, texture, taste and appearance.

The outcome of both studies suggests that in order to attract new consumers, the focus should not be on health and ecological aspects of meat substitute products. Higher acceptance levels of meat substitutes in the UK might be explained by a greater number of vegetarians in that country and a higher interest in ethical aspects, which are both less pronounced in the Netherlands. When targeting non-users or light/medium users, more attention should be paid to luxury aspects and meat-like sensory properties. Unfamiliarity with the product and, to some extent, food neophobia can be a barrier to acceptance of NPFs.

Identification of substitutes

Obviously, the overall aim of PROFETAS implies that NPFs should be recognized as products that can be used instead of meat. Since it is not possible yet to develop an exact imitation of meat, it was assumed that NPFs should not mimic a meat product. The advantage of this assumption is that consumers do not expect a meaty taste or texture, which will reduce the risk of disappointment. On the other hand, “familiarity” plays an important role in acceptance (see above). Research indicates that consumers use categories to identify objects (Rosch and Mervis, 1975). Categories can be formed on the basis of perceived similarity and resemblance of products and are used to identify substitutes in the same or similar category. In view of this, a qualitative consumer study was carried out to explore which product attributes consumers used to identify a substitute for meat.

Since mainly extrinsic product characteristics are a source of information to consumers during shopping, the focus in this study was on the following product characteristics: information on label or package, package appearance, product appearance, and position in the supermarket. Semi-

structured in-depth interviews were held with 15 respondents (students and employees of a non-agricultural university), in which they were asked to imagine themselves in an unfamiliar supermarket abroad looking for a substitute for meat, such as a vegetarian schnitzel. Almost every respondent answered that looking for the meat section in the store would be the first action. Subsequently respondents mentioned that they would pay attention to shape of the product, the product name (“vegetarian schnitzel”), the colour of the package (“green”), and phrases on the label such as “vegetarian”, “meat substitute” or “soy”. Results were also confirmed in a questionnaire-based survey (n=63). Thus, the position in the supermarket, product name and label information (reference to meat) can be crucial in the identification of NPFs as a substitute for meat in a meal. Future studies will further explore the role of associations (such as “green”) and categorisation (“meat section”) in identification of meat substitutes.

Consumption experience

Two main factors related to food choice are the physiological effects of foods and the sensory perception of physico-chemical properties of foods. These factors were studied by determining the satiating properties and changes in acceptability of existing meat substitutes and meat products after repeated ingestion, in relation to their sensory properties.

Satiety

Satiety is one of the physiological consequences of ingesting foods; it has been defined as the state that occurs after an eating episode, and that inhibits further eating (Blundell and Rogers, 1991). In the survey described above it appeared that respondents gave low scores for satiating properties of meat substitute products. In addition, an inventory of the nutritive value of products currently on the market revealed that some meat substitute products have a substantially lower protein content than meat, which is known to influence satiety sensation. Therefore, a study was performed to explore satiety scores of several meat substitutes compared to meat. Non-vegetarian students (n=28, 7 males) joined a consumption experiment during six days. Each day, meat or a meat substitute was randomly provided to each participant (males: 250 g; females: 200 g) in a lunch setting, and satiety measures (satiety scores on a 100 mm anchored line scale and amount eaten during a test meal) were taken until 2.5 hours after lunch. The selected products were four meat substitutes products and two meat products that were comparable in energy contents, but variable in protein contents. This resulted in an intake ranging from 20 g protein (two different meat substitutes with low protein content) to 71 g protein (two different meat substitutes with a high protein content) during those six lunches (for men).

The protein contents of the meat products selected for this study were in between these values. Comparing the subjective satiety sensations after consumption of these products, a trend was observed towards high protein meat substitutes resulting in lower hunger scores (mean hunger score is 33.2) than low protein meat substitutes (mean hunger score is 39.0), which was in line with our expectations. These preliminary results indicate that there is an observable difference in satiety sensations after consumption of different meat and meat substitute products that vary in protein content.

Sensory and hedonic evaluation

In preparation of a repeated exposure test (see the next paragraph), a pilot study was carried out to assess the liking scores of consumers for different, currently available meat substitutes that are used as ingredients in a meal. We were also interested in the similarity to meat perceived by these panellists. The consumer panel consisted of 23 non-vegetarian participants (mean age 26 years, 70% females), ranging from low to heavy users of meat substitutes. Six meat substitutes (minced, pieces, strips and cubes of different brands) were selected for this study and one reference meat product (chicken breast pieces). Unlabeled samples were presented in random order and 100 mm unstructured line scales were used for ratings. Results showed that chicken breast was the most liked sample before (smell and appearance only) and after tasting and had the highest intention to use. The meat substitute based on mycoprotein (pieces) was the most preferred meat substitute product after tasting and had the highest similarity to meat scores (overall similarity, and similarity in taste). Only 57% of the participants identified this product as a meat substitute, others were uncertain or thought the sample was a meat product. These results indicate that meat-like properties of meat substitutes play an important role in acceptance of these products. The role of sensory properties is more extensively described in Section 4.4.

Repeated consumption

Consumers may change their opinions on a food product after repeated consumption of the same food product over longer periods of time (Schutz and Pilgrim, 1958; Siegel and Pilgrim, 1958). Certain products seem to become “boring” or disliked, the latter resulting in low repeated purchases (Zandstra *et al.*, 2004). Concerning meat and meat substitute products we noticed that “heavy users” of meat substitutes eat these products usually a few times per week, in contrast to meat consumers who eat meat during the hot meal five times per week, or even more. Are meat substitutes too boring after a while? To achieve a successful replacement of meat by NPFs in the long run, insight into product properties and other factors playing a role in long-term acceptance of these products is essential. As an example of how

this can be investigated, we organized a consumer in-home use test with repeated exposure (twice a week during a period of ten weeks) to either a commercial meat substitute product or a reference meat product. The main outcome of such a study is the change in liking of meat substitute products compared to a reference meat product after repeated consumption in a realistic setting. By comparing several meat substitutes, it is possible to assess, for example, whether a meat substitute that shows more similarity to meat is more acceptable over time than a meat substitute with less meat-like properties.

3.3 Conclusions

The food choice studies described above illustrate the variety of factors that may play a role in the replacement of meat by meat substitutes. Various scientific disciplines, such as nutritional science, food science, psychology, and marketing should be consulted in further research. The main point of this section is that targeting new (non-vegetarian) consumers for NPFs may offer interesting opportunities to distinguish these products from current meat substitutes. Given the sheer number of these consumers, this strategy may ultimately have the most beneficial effects in terms of environmental sustainability. However, this segment of consumers does not share vegetarian ideologies and will not be attracted by the environmental argument. These consumers tend to choose more conventionally and seem to prefer a meat-like product, as was replicated in an actual tasting test. Meat-like characteristics (e.g. appearance, packaging) also have a role for the identification of NPFs as a substitute for meat. Product characteristics such as satiating properties (referring to relative protein content) need attention in product development of NPFs as well.

4. SUBSTITUTION OF MEAT BY NPFs: SENSORY PROPERTIES AND CONTEXTUAL FACTORS

Hanneke Elzerman

4.1 Introduction

Sensory characteristics play an important role in the acceptance of foods. In order to achieve a transition from meat consumption towards more

sustainable NPFs based on plants, these foods should have sensory characteristics that are appealing to consumers. A consumer-driven approach is seen as the key to success for new product development, as can be concluded from the large number of publications on this topic (Costa *et al.*, 2001; Van Trijp and Steenkamp, 1998). This approach, in which consumer wishes are taken as a starting point for product development, is also used here. The goal of the present project is to explore methods that may identify consumers' sensory expectations and preferences of NPFs. These methods can be used as a toolbox for consumer-driven product development.

As mentioned in Chapter 1, it is not considered feasible to strive for NPFs that can replace large pieces of meat, such as steaks or cutlets. Therefore, we chose to focus on NPFs that can be used as ingredients in a dish (in minced form, slices or pieces). This implies that the whole dish, and not just the NPF-ingredients, will determine the acceptance of these foods. The appropriateness of the use of these NPF-ingredients in different dishes seems to be of crucial importance for the acceptance of NPFs. That is why appropriateness in the context of a dish has been a central topic of this project.

The role of the context of a dish or meal on the acceptance of foods has hardly been studied before. Turner and Collison (1988) studied the role of meal components (starter, entrée, sweet) on the acceptance of a meal. Stallberg-White and Pliner (1999) tested the hypothesis that the addition of familiar flavours to novel staple foods would decrease the “neophobia” (fear of new things) by consumers. They found that the addition of a familiar sauce to a novel food increased subjects' willingness to taste it. Context in the meaning of a situation in which a food is eaten has been the subject of several studies. The importance of other “contextual factors” and the appropriateness of the use of foods in a situation have been recognized, for example, by Cardello and Schutz (1996) Schutz (1994), Rozin and Tuorila (1993) and Meiselman *et al.* (2000). It was concluded that when, where, how, with whom or with what you eat a food are important determinants for the acceptance of foods.

The project focused on the acceptance of “meat substitute ingredients” by consumers in a naturalistic environment. Consumers tasted these products in a university dining hall, which is a far more normal setting for consumers than sensory booths. The products were evaluated both in several dishes and “as such”. In addition, we looked deeper into the products with a trained sensory panel that described them with objective sensory attributes. Furthermore, we looked at meat substitutes in a broader context by analysing the differences in appropriateness between meat substitutes and meat (products) in several food use situations.

An important complicating factor is that consumers can only give sensory preferences after they have eaten or at least seen or smelled a product. Pea-based NPFs are new foods that do not exist yet. Therefore, commercially available meat substitutes have been used in the various studies. Meat substitutes were defined as products that have been developed to substitute meat in a dish. Fish, cheese, nuts, eggs, etc. are not considered meat substitutes.

4.2 Results

Consumers' experiences and expectations of meat substitutes

From a market exploration in 2001, we concluded that there are over 150 meat substitutes on the Dutch market. These products vary from plain tofu and vegetarian burgers and schnitzels to meat substitute ingredients (pieces, mince, slices), snacks and sandwich toppings. The main ingredient is mostly soy protein, but it can also be wheat protein, mycoprotein (fungi) or a mixture of vegetables. It was stated in an earlier report on NPFs that most available meat substitutes were not well accepted by consumers. The main deficiency would be the texture properties of most products (Sijtsma *et al.*, 1996).

To get more insight into the factors that are important in the acceptance of meat substitutes, we conducted qualitative consumer research using focus group discussions (Greenbaum, 1998; Krueger and Casey, 1988). Experiences of 46 consumers who had some experience with meat substitutes were elaborated. Consumers discussed why, when and how they used meat substitutes, and what their opinion was on these products (both from a practical and from a sensory point of view). After the general part of the focus group, consumers discussed the appropriateness of the use of meat substitutes in different dishes that were shown on photographs. The focus group discussions were concluded with a small tasting session in which consumers tasted meat substitutes in a dish and discussed their liking for the products.

Many positive and negative aspects of meat substitutes were mentioned. The remarks that were made can be divided into general and sensory aspects that describe the products. General remarks were mainly on the image of meat substitutes. "Meat substitutes" was considered a bad name, there was concern for genetic modification, and meat substitutes were found unnecessary products. Also, the lack of information on the package (on the origin of ingredients, preparation, and recipes) was often mentioned. Health aspects were mentioned both in a positive and in a negative meaning (low fat, high protein were found positive aspects, whereas low protein and artificial flavourings were considered negative aspects). Many consumers

believed that meat is needed by children, in particular for its vitamin and mineral content. Finally, meat substitutes were often called expensive.

Sensory remarks that were made about the appearance of meat substitutes were that most products looked like meat products. For some consumers this was a positive and for others this was a negative aspect. Also, some consumers liked the taste and the texture of meat substitutes, whereas others disliked it. Furthermore, negative flavour aspects that were mentioned included: bland taste or too spicy, chemical aftertaste, dryness, stickiness, softness, sponginess, hardness, compactness, and toughness. Positive remarks included: chicken-like texture, granular texture, crispy crust, and neutral taste.

Most consumers found the use of novel protein foods appropriate in the meals that were shown on the photos (soup, pasta, rice, wrap, salad meal, and pizza). However, some consumers rejected the use of meat substitutes on pizzas, in meal salads and in soups. The results of these focus group discussions were used as a basis for further studies.

Appropriateness and liking of meat substitutes based on visual information

Based on the focus group discussions and pilot studies, we hypothesized that the context of the dish influences the acceptance of meat substitutes. To get more insight into the role of appropriateness on the acceptance of meat substitutes, we developed an Internet questionnaire in which we could show photographs of many meat substitute meal combinations to many consumers in a relatively quick way. The main goal of this questionnaire was to find out whether consumers find meat substitutes appropriate in different dishes and what kind of meat substitutes would be the most (or the least) appropriate. The on-line questionnaire consisted of:

- General appropriateness questions (e.g. how appropriate do you find the use of a meat substitute in a soup?)
- More specific appropriateness questions, based on photographs of combinations of meat substitutes and various dishes (e.g. how appropriate do you find the use of this meat substitute in this soup?)
- Questions on sensory aspects of meat substitutes

The study yielded 251 completed questionnaires. The main results were that a pasta dish, a rice dish or a wrap (pancake with filling) were considered more appropriate for the use of meat substitutes than a soup, a pizza or a meal salad. These results are in line with those of the focus group discussions. The top 3 of the most appropriate and least appropriate combinations of meat substitutes and dishes are shown in Table 4.4. As can be concluded from the table, most consumers prefer “familiar” combinations

in which a meat substitute looks like the meat product it is replacing. There were no large differences between different consumer groups.

Table 4-4. Top 3 of the most appropriate combinations of dishes and meat substitutes and of the least appropriate combinations (out of 30 combinations in total).

Most appropriate		Least appropriate	
Spaghetti	Mince	Wrap	Slices
Wrap	Mince	Rice	Slices
Rice	Pieces	Pizza	Cubes

Brown was considered the most appropriate colour for meat substitutes, as it was indicated to be a positive colour by 80% of the respondents. Green was the least appropriate colour (indicated as a positive colour for meat substitutes by only 15% of the respondents). Other favoured properties for meat substitutes were: soft, smooth, crispy, seasoned, spicy and meat-like flavour.

Situational appropriateness of meat substitutes

The focus group discussions and a pilot study suggested that consumers find the use of meat substitutes less appropriate than meat in certain situations. For example, when consumers want to eat something “luxurious”, they find a meat substitute not appropriate, unlike several meat products. This is in line with the findings of the survey described in Section 4.3. To learn more about the situational appropriateness of meat substitutes we developed a questionnaire. The situations were based on focus group discussions and the products that were used in this questionnaire covered a large part of the meat substitute product types. Meat products featured in this questionnaire as well. The questionnaire showed a photograph of the product and a list of 22 situations. Respondents had to rate the appropriateness of the products in each of the situations on a 5-point scale (1=not at all appropriate and 5=very appropriate). This project is currently being carried out. The results can be used by marketers to better position meat substitutes.

Appropriateness and liking of meat substitutes based on consumption

Sensory consumer studies provided insight into important factors for the acceptability of meat substitutes. In this study, about 100 consumers tasted combinations of dishes with meat substitutes and meat substitutes as such. The meat substitutes and dishes that were used in this study are shown in Table 4.5. A standardized method for preparation and serving of the dishes was developed first. All dishes were served hot, except for the salad. The samples were consumed in a university dining room. The respondents scored the samples (in a randomised order) on appropriateness of the use of meat

substitutes in dishes, and on expected liking, overall liking, liking of appearance, taste and texture. The data are currently being analysed.

Table 4-5. Meat substitutes (with their main ingredient) and dishes used in the sensory consumer study (25 combinations of meat substitutes and dishes were tasted). Products 1-5 were pieces and product 6 was mince.

Meat substitute	Dish
Product 1 (wheat protein)	Dish 1: Rice with curry sauce
Product 2 (tofu (soy))	Dish 2: Rice with sweet & sour sauce
Product 3 (mycoprotein)	Dish 3: Rice with peanut sauce
Product 4 (wheat protein)	Dish 4: Spaghetti with tomato sauce
Product 5 (soy protein)	Dish 5: Tomato-vegetable soup
Product 6 (mycoprotein)(mince)	Dish 6: Pasta salad

Sensory description of meat substitutes

To better understand consumer liking and to be able to give directions to product developers in terms of product specifications, we conducted a descriptive analysis of meat substitutes. A sensory panel with 18 panellists was trained for Quantitative Descriptive Analysis® of 12 commercially available meat substitutes (in pieces and minced) (Stone *et al.*, 1974). The pieces were described by 21 sensory attributes and the minced meat substitutes by 22 sensory attributes (appearance, smell, taste, and texture). The appearance of the products was similar in colour, but differed in the size of the granules. The composition of the products was quite different. Most products (such as tofu) contained soy protein as the main ingredient, whereas others were made of a mixture of soy protein, wheat protein, or pea protein. One product was made from mycoproteins (see Section 3.1). Figure 4.4 shows two spider plots of the scores of the minced meat substitutes on different texture and flavour attributes. Please note that the products in Figure 4.4 are different from the ones mentioned in Table 4.5 and that the plots are only meant to illustrate the type of results.

Preliminary results suggest that the panel detected large differences between the products, especially for sour and rye bread flavour, saltiness, bitterness, toughness and juiciness. These descriptive data can be related to the sensory consumer data to find out which product properties of meat substitute ingredients consumers like or do not like.

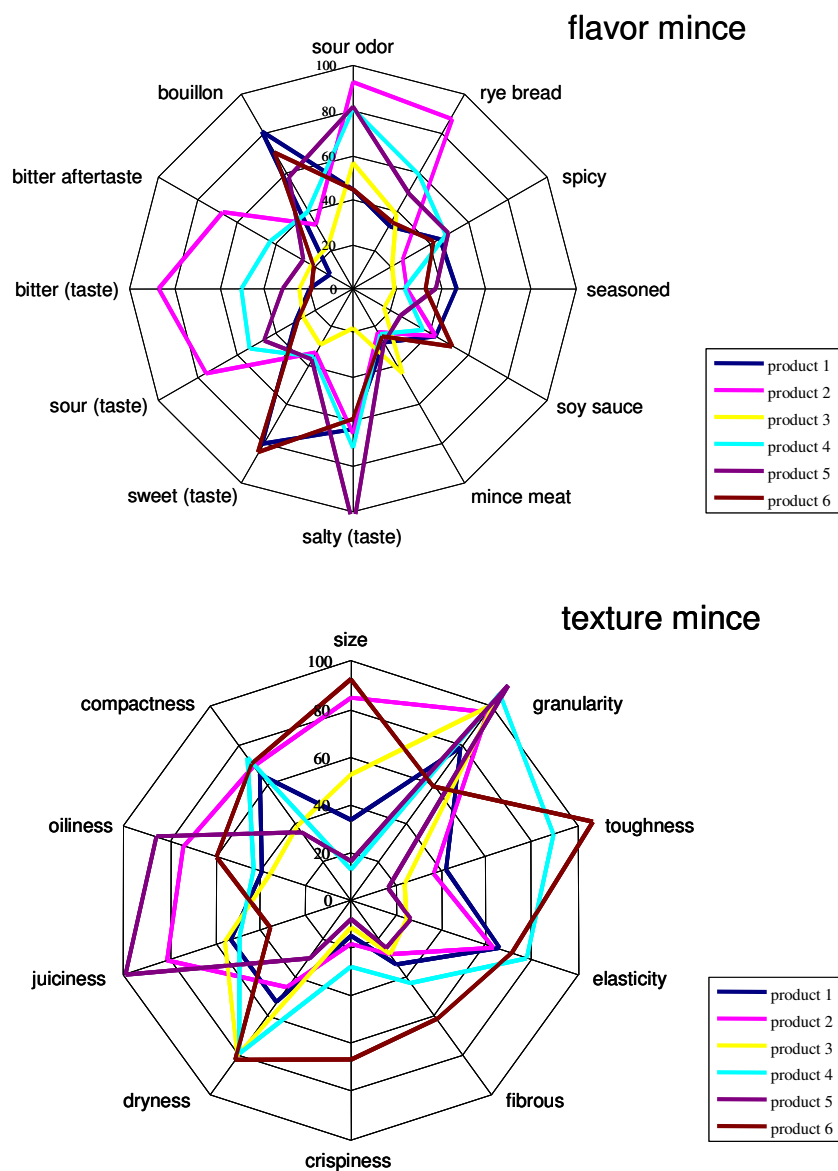


Figure 4-4. Spider web plots of the mean scores of the sensory panel on 22 sensory attributes (11 flavour and 11 texture attributes) for minced meat substitutes. The figure on top shows the flavour attributes (taste: bitter, sour, sweet, and salty; and odour: bouillon, sour, rye bread, spicy, seasoned, soy sauce, and minced meat), and the figure below shows the texture attributes (based on appearance: size; and based on mouth feel: granularity, toughness, elasticity, fibrous, crispiness, dryness, juiciness, oiliness, and compactness).

4.3 Conclusions

All studies taken together can give more insight into consumers' sensory preferences of meat substitutes and, more importantly, which sensory attributes and contextual factors are responsible for these preferences. In the focus groups and in the appropriateness questionnaire consumers gave their opinions about liking and appropriateness of meat substitutes based only on descriptions of the foods, food names and visual information. From these studies it can be concluded that only a small group of consumers is open to new products that are really different in appearance and flavour from the existing meat substitutes. However, the majority of consumers want meat substitutes to have a meat-like flavour and a brown colour. As far as the appropriateness of the use of meat substitutes in different meals is concerned, most consumers want combinations that are more or less familiar to them. They want the meat substitute to take exactly the same place in the dish as the meat it is replacing.

If these preferences are confirmed in other consumption studies, they can be coupled to the sensory data of the descriptive panel. Ultimately, these preferences could then be "translated" into measurable product properties, and used by product developers for the design of NPFs. However, valid instrumental (physical and chemical) methods for the measurements of all sensory characteristics of solid foods are not yet available (Rosenthal, 1999). In order to make this translation, evidently more research needs to be done in this field.

5. CONCLUSIONS

Joop de Boer

This chapter was intended to examine whether a diet shift is socially desirable in view of the preferences of consumers and producers. The underlying notion was that the better a diet shift fits into the behavioural patterns of current and future generations, the more desirable it is. In addition, it was argued that a lack of fit does not have to cause an insurmountable problem if measures can be taken to mitigate the main shortcomings. Because these issues cannot be analysed directly, several indirect approaches were used. Based on a long-term view on behaviour, the potential for a diet shift in relation to socio-cultural changes was examined. At the more detailed level of food choices and sensory experiences

consumer-directed methods were developed that may guide NPF product development.

One of the most salient results of this chapter is the contrast between, on the one hand, a series of impressive changes in dietary choices during the last few centuries and particularly during the last few decades and, on the other hand, the observation that an individual will not easily change his or her food preferences from one day to the next. This contrast underlines the value of our analytical framework, which sorts influences on behaviour into a logical order (Figure 4.1). Its cascade-like structure expresses the view that a long-term development will create opportunities for food choices that match its general direction, whereas it will put constraints on others. According to Section 4.2, there is a favourable socio-cultural context for decisions that make consumers and producers less dependent on meat proteins. However, it appears that the currently available meat substitutes will not become popular without additional measures. The consumer studies described in Sections 4.3 and 4.4 clearly showed that many consumers left alone with a choice between a currently available meat substitute and meat would prefer the latter.

The consumer studies also demonstrated that NPFs should be meat-like products that have the same place in the dish as meat. These results confirm the notion mentioned in Section 4.1 that people will habitually look for what is familiar when they are trying to make sense of something, such as an invitation to try a new product. This retrospective character of sense making can explain that non-vegetarian consumers keep relying on distinctions drawn in the past and that they evaluate meat substitutes by using meat-based criteria. Product developers should keep in mind that people are only able and willing to re-examine and revise their existing concepts at certain moments of change (i.e. discontinuously instead of continuously). Only clearly perceived benefits of a new product may stimulate them to supplement existing concepts and criteria. Importantly, the evidence presented in this chapter suggests that the ecological or moral benefits of NPFs will not be sufficient to change these consumers' minds.

By using currently available meat substitutes as a model, it was possible to develop several tools that may guide NPF product development, even though the most sensory and other characteristics of the former and the latter are likely to differ. A drawback of this approach may be that the current meat substitutes are in fact sold in a niche market and that they are almost twice as expensive as the cheapest meats. In contrast, pea-derived NPFs may be developed to produce cheap protein products for multiple purposes. Whether these products will be attractive and acceptable in terms of relevant consumer motives remains to be seen. This chapter has demonstrated,

however, that there is now a robust set of tools to develop NPF products in a consumer-driven way.

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